CLAIMS :

1. Dental radiology apparatus, characterized in that it comprises:

- an intraoral sensor comprising a detector that includes an active pixel array produced using biCMOS technology and converting received x-rays into at least one analog electrical output signal,

- an electronic module encapsulated in a case and which has at least one detector activation device, the module being linked to the sensor by a wire link for the transmission to said sensor of a detector activation signal generated in the module and for the transmission to the module of said at least one analog electrical output signal, the module having analog-digital conversion means of said at least one analog electrical output signal into at least one digital output signal,

- a remote processing and display unit of said at least one digital output signal which is linked to the electronic module by a wire link intended to ensure the transmission to the unit of said at least one digital output signal.

2. Apparatus according to claim 1, characterized in that the encapsulated electronic module has weight and dimensions suited to enable, when the apparatus is used, the sensor to be held in a patient's mouth when said encapsulated electronic module is suspended from said sensor.

3. Apparatus according to claim 1 or 2, characterized in that the electronic module is at a distance of between 50 cm and two meters from the sensor.

4. Apparatus according to one of the claims 1 to 3, characterized in that the encapsulated electronic module is nearer the sensor than the processing and display unit.

5. Apparatus according to one of the claims 1 to 4, characterized in that said at least one activation device is a pushbutton.

6. Apparatus according to one of the claims 1 to 5, characterized in that each wire link is a cable.

7. Apparatus according to claim 6, characterized in that, each cable being inserted at one of its ends into the case, the electronic module is fitted with anti-pull devices that are each capable of working together with one end of one of the cables to prevent the removal of the corresponding cable from the case by pulling action exerted on said cable.

8. Apparatus according to claim 7, characterized in that, each cable having a coaxial sheath with a bundle of electrical wires, opposite the end of each cable that inserts into the case, the part of the corresponding wire bundle is made solid with a metal anti-pull body of the corresponding anti-pull device.

9. Apparatus according to claim 8, characterized in that the electronic module comes in the form of a printed circuit board with overall elongated shape along a longitudinal axis and having, at each of the two opposite ends arranged longitudinally, an axial cut-out open to the outside of the circuit to house in the longitudinal direction a metal anti-pull body and the part of the corresponding wire bundle made solid and aligned, the cut-out being made to prevent removal of the body in this longitudinal direction.

10. Apparatus according to claim 9, characterized in that each metal anti-pull body is provided with fitting elements arranged on the opposite sides parallel to the direction of the part of the wire bundle made solid with the body and which work together with the complementary fitting elements respectively arranged on the opposite longitudinal edges of the corresponding cut-out.

11. Apparatus according to one of the claims 8 to 10, characterized in that each part of each of the wire bundles made solid with an anti-pull body is made solid with a cylindrical drum that, on the one hand, surrounds the latter and, on the other hand, is held solid with the corresponding body.

12. Apparatus according to one of the claims 8 to 11, characterized in that each part of each of the wire bundles made solid with an anti-pull body is welded directly or indirectly to the latter.

13. Apparatus according to one of the claims 9 to 12, when claims 11 and 12 depend on claim 9, characterized in that two metal half-shells are arranged on either side of the printed circuit board and assembled together so as to ~~secure~~ shield said printed circuit board.

14. Apparatus according to one of the claims 1 to 13, characterized in that the case has at least two plastic parts forming a cover and which are assembled together to encapsulate the electronic module.

15. Apparatus according to one of the claims 1 to 14, characterized in that the case has an external surface that can be disinfected.

16. Apparatus according to claim 15, characterized in that the shapes of the external surface are of a kind not to encourage the incrustation of dirt.

17. Apparatus according to claim 15 or 16, characterized in that the external surface is drip-proof.

18. Apparatus according to one of the claims 1 to 17, characterized in that the wire link between the electronic module and the processing and display unit complies with standard USB2.0.

19. Apparatus according to one of the claims 1 to 18, characterized in that the sensor has an x-ray converter that is capable of converting the x-rays that have passed through a tooth into visible radiation.

20. Apparatus according to claim 19, characterized in that the biCMOS detector including the active pixel array is capable of converting at least one part of the visible radiation coming from the conversion of the x-rays into at least one analog electrical output signal.

21. Dental radiology apparatus, characterized in that it comprises an intraoral sensor intended to receive x-rays that have passed through at least one tooth, said sensor including:

- an x-ray to visible radiation converter,
- a detector comprising an active pixel array produced using biCMOS technology on a substrate made of semi-conductor material,
- a sequencer capable of generating several control signals to control the active pixel array, said sequencer being integrated on the same substrate as the array.

22. Dental radiology apparatus according to claim 21, characterized in that the sequencer is capable of receiving at least one signal external to the sensor from which the control signals are generated.

23. Dental radiology apparatus according to claim 21 or 22, characterized in that it has an electronic module separate from the sensor and which is capable of generating said at least one signal external to the sensor, from which the control signals are generated.

24. Dental radiology apparatus according to claim 23, characterized in that it has a link between the electronic module and the sensor for the transmission of said at least one external signal.

25. Dental radiology apparatus according to claim 24, characterized in that the link is a wire link.

26. Signal processing method in a dental radiology apparatus comprising an intraoral sensor that includes an active pixel array produced using biCMOS technology, characterized in that the method has the following steps:

- sampling of the data values held by the pixels of the array having been exposed to a radiation,

- generation of at least one sensor analog output signal based on the data values sampled on the pixels,

- conversion of said at least one analog output signal into one digital output signal,

- application of a correction to the analog output signal or to one of the analog output signals, to compensate in the digital output signal for any drifts due to the variations of the dark current in the array.

27. Method according to claim 26, characterized in that the application step of a correction takes account of at least one value of a correction signal that is generated from the data values sampled on the array's pixels when it is not exposed to any radiation.

28. Method according to claim 27, characterized in that the correction signal is generated between two exposure phases of the array to radiation.

29. Method according to claim 27 or 28, characterized in that the correction signal is generated regularly over time.

30. Method according to one of the claims 27 to 29, characterized in that it comprises steps of generation and analog-digital conversion of a sensor analog correction and output signal prior to the step of correction application.

31. Method according to one of the claims 27 to 30, characterized in that it comprises a step of digital-analog conversion of at least one value of the digital correction signal into an analog correction signal that is applied to the analog output signal or to one of the analog output signals.

32. Method according to one of the claims 26 to 31, characterized in that it comprises a step of producing a single analog output signal based on two symmetrical analog output signals.

33. Method according to one of the claims 26 to 31, characterized in that it comprises a step of producing a single analog output signal based on two analog output signals, consecutive to the step of correction application to one of the two signals.

34. Method according to claim 32 or 33, characterized in that the step of producing a single analog output signal based on two analog output signals is a summing step of the two analog output signals.

35. Method according to one of the claims 32 to 34, characterized in that the step of producing a single output signal is performed in a digital-analog converter.

36. Method according to one of the claims 32 to 34, characterized in that the application step of a correction to the analog output signal or to one of the analog output signals is adjusted according to the law of variation according to the time of the dark current of the biCMOS active pixel array and the duration of use of this array.

37. Method according to one of the claims 26 to 36, characterized in that it comprises a step of transmission of said at least one analog output signal to an electronic module remote from the sensor, the steps of conversion and correction application being performed in said remote module.

38. Method according to claim 37, characterized in that it comprises a transmission step of the compensated digital output signal from the remote electronic module to a remote signal processing and display unit.

39. Method according to claim 38, characterized in that the transmission is carried out using a wire link enabling a transmission speed at least equal to that of standard USB2.0.

40. Method according to one of the claims 26 to 39, characterized in that it includes a prior step of reception by the sensor of x-rays having passed through at least one tooth.

41. Method according to claim 40, characterized in that it includes a later step of conversion into visible radiation of the received x-rays, the array's pixels being exposed to visible radiation.

42. Dental radiology apparatus, characterized in that it comprises an intraoral sensor including:

- a detector comprising an active pixel array produced using biCMOS technology and converting x-rays received by the array into at least one analog output signal,

the apparatus comprising:

- an analog-digital converter for converting said at least one analog output signal into one digital output signal,

- a signal corrector that is suited to applying a correction to the analog output signal or to one of the analog output signals, to compensate in the digital output signal for any drifts due to the variations of the dark current in the array.

43. Apparatus according to claim 42, characterized in that the corrector signal is suited to applying a correction according to at least one value of a correction signal that is generated from the data values sampled on the array's pixels when it is not exposed to any radiation.

44. Apparatus according to claim 43, characterized in that the detector is adjusted to generating a correction signal between two exposure phases of the array to x-rays.

45 Apparatus according to claim 43 or 44, characterized in that the detector is adjusted to generating a correction signal regularly over time.

46. Apparatus according to one of the claims 43 to 45, characterized in that it comprises:

- means for generating a sensor analog correction and output signal,

- means for the analog-digital conversion of said analog signal thus generated.

47. Apparatus according to one of the claims 43 to 46, characterized in that it comprises a digital-analog converter to convert at least one value of the digital correction signal into an analog correction signal that is applied to the analog output signal or to one of the analog output signals.

48. Apparatus according to one of the claims 42 to 47, characterized in that it comprises a means of amplification of each of the two analog output signals.

49. Apparatus according to claims 47 and 48, characterized in that the digital-analog converter is linked at the output to one of the amplification means of one of the two analog output signals.

50. Apparatus according to one of the claims 42 to 49, characterized in that it comprises a preparation circuit of a single analog output signal based on two symmetrical analog output signals.

51. Apparatus according to claim 50, characterized in that the analog output signals are symmetrical with one another.

52. Apparatus according to claim 50 or 51, characterized in that the production circuit of a single signal is a summing circuit of the two analog output signals.

53. Apparatus according to claim 52, characterized in that the summing circuit is a differential operational amplifier.

54. Apparatus according to one of the claims 50 to 53, characterized in that the production circuit of a single signal is integrated in the analog-digital converter.

55. Apparatus according to one of the claims 42 to 54, characterized in that it comprises:

- an electronic module remote from the sensor and which includes the analog-digital converter and the signal corrector,

- a link between the electronic module and the sensor to transmit said at least one analog output signal.

56. Apparatus according to claim 55, characterized in that it comprises a processing and display unit of said at least one output signal from the sensor that has been digitized and compensated, the unit being remote from the electronic module.

57. Apparatus according to claim 56, characterized in that it comprises, between the module and the processing and display unit, a communication wire link permitting a transmission speed at least equal to that of standard USB2.0 for the transmission of said at least one digitized and compensated output signal.

58. Apparatus according to one of the claims 42 to 57, characterized in that the sensor has an x-ray converter that is capable of converting the x-rays that have passed through a tooth into visible radiation.

59. Apparatus according to claim 58, characterized in that the biCMOS detector including the active pixel array is capable of converting at least one part of the visible radiation coming from the conversion of the x-rays into at least one analog electrical signal.

60. Dental radiology apparatus, characterized in that it comprises an intraoral sensor intended to receive x-rays that have passed through at least one tooth, said sensor including:

- an x-ray to visible radiation converter,

- a detector comprising an active pixel array produced using biCMOS technology and converting the visible radiation thus converted into at least one analog electrical signal,

- a generator of a sampling signal synchronized with said at least one analog electrical signal and which is intended for the later conversion of said at least one analog electrical signal into a digital signal.

61. Dental radiology apparatus according to claim 60, characterized in that it comprises:

- an electronic module remote from the sensor,

- a link between the electronic module and the sensor for the simultaneous and in phase transmission of said at least one electrical signal and of the sampling signal.

62. Dental radiology apparatus according to claim 61, characterized in that the electronic module comprises an analog-digital converter for converting said at least one analog electrical signal into one digital signal based on the sampling signal.

63. Dental radiology apparatus according to claim 61 or 62, characterized in that the link between the electronic module and the sensor is a wire link.

64. Dental radiology apparatus according to one of the claims 60 to 63, characterized in that it comprises a signal generator which is capable of generating,

based on one analog electrical signal from the detector, two differential analog electrical signals.

65. Dental radiology apparatus according to claims 61 and 64, characterized in that the signals generator is integrated into the sensor, the link ensuring the simultaneous and in phase transmission of the two differential analog electrical signals and the sampling signal.

66. Dental radiology apparatus according to one of the claims 60 to 65, characterized in that the sensor comprises a sequencer that is capable of generating several control signals of the active pixel array and which includes the sampling signal generator.

67. Signal processing method in a dental radiology apparatus comprising an intraoral sensor intended to receive x-rays that have passed through at least one tooth, characterized in that it includes the following steps performed in the sensor:

- reception of x-rays having passed through at least one tooth,
- conversion of the received x-rays into visible radiation,
- transformation of the visible radiation thus converted into at least one analog electrical signal by an active pixel array produced using biCMOS technology,
- generation of a sampling signal synchronized with said at least one analog electrical signal and which is intended for the later conversion of said at least one analog electrical signal into a digital signal.

68. Method according to claim 67, characterized in that it comprises a step of simultaneous transmission of in-phase signals of said at least one analog electrical signal and the sampling signal to an electronic module remote from the sensor.

69. Method according to claim 68, characterized in that it comprises an analog-digital conversion step of said at least one analog electrical signal into one digital signal based on the sampling signal.

70. Method according to claim 69, characterized in that the conversion step is performed in the electronic module.

71. Method according to one of the claims 68 to 70, characterized in that the transmission is performed by means of a wire link.

72. Method according to one of the claims 67 to 71, characterized in that it comprises a generation step, based on one analog electrical signal from the array, of two differential analog electrical signals.

73. Method according to claims 68 and 72, characterized in that the generation step of the two signals is performed before their simultaneous transmission with the sampling signal.

74. Method of signal processing in a dental radiology apparatus comprising an intraoral sensor that includes a detector including an active pixel array produced using biCMOS technology, the pixels being arranged in rows and columns, characterized in that it comprises the following steps:

- selection of each row of the array,
- for each row selected, sampling of the data values held by each pixel having been exposed to radiation,
- generation of a read signal from the sampled data values for the array's pixels,
- application at the detector's input of an input reference signal (black-in),
- production of an output signal based on the array's read signal and an output reference signal (black-ref) representative of the detector's intrinsic electronic drifts and which is obtained at the detector output based on the input reference signal applied at said detector's input.

75. Method according to claim 74, characterized in that the output signal is produced by forming a difference between the array's read signal and the output reference signal (black-ref).

76. Method according to claim 74 or 75, characterized in that for each array row selected, after the first sampling step, the method includes a second sampling step of the data values obtained after resetting each pixel.

77. Method according to claim 76, characterized in that it includes a step of applying a resetting signal to each selected row between the two sampling steps.

78. Method according to claim 76 or 77, characterized in that the array's read signal is generated by calculating the difference between the data values held by the array's pixels and obtained respectively after each sampling of the same pixel.

79. Method according to one of the claims 74 to 78, characterized in that the input reference signal is DC voltage.

80. Method according to one of the claims 74 to 79, characterized in that it includes a step of receiving the input reference signal that comes from an electronic module remote from the sensor.

81. Method according to one of the claims 74 to 80, characterized in that prior to the first sampling step, the pixel array is exposed to visible radiation coming from the conversion of an x-ray having passed through a tooth.

82. Method according to one of the claims 74 to 81, characterized in that the produced output signal is an analog output signal.

83. Method according to claim 82, characterized in that the analog output signal is delivered by the sensor.

84. Method according to claim 82 or 83, characterized in that it includes a step of converting the analog output signal into a digital output signal.

85. Method according to one of the claims 74 to 84, characterized in that it includes a step of transmitting the output signal to an electronic module remote from the sensor.

86. Method according to claims 84 and 85, characterized in that the conversion step is performed in the electronic module.

87. Dental radiology apparatus comprising an intraoral sensor that includes a detector including an active pixel array produced using biCMOS technology, the pixels being arranged in rows and columns, characterized in that it comprises:

- means for selecting each row of the array,
- means for sampling the data values held by each pixel having been exposed to radiation, for each row selected,
- means for generating a read signal from the sampled data values for the array's pixels,
- means for applying at the detector's input an input reference signal,
- means for producing an output signal from the array's read signal and an output reference signal (black-ref) representative of the detector's intrinsic electronic drifts and which is obtained at the detector output based on the input reference signal applied at said detector's input.

88. Apparatus according to claim 87, characterized in that production means of an output signal are means for forming a difference between the array's read signal and the output reference signal (black-ref).

89. Apparatus according to claims 87 or 88, characterized in that it comprises means of applying a resetting signal to each selected row and whose pixel data values have been sampled a first time, the sampling means being adjusted to sample the data values held by each reset pixel.

90. Apparatus according to claim 89, characterized in that the means of generation of a read signal more particularly include means of forming the difference between the data values held by the array's pixels and obtained respectively after each sampling of the same pixel.

91. Apparatus according to one of the claims 87 to 90, characterized in that the input reference signal is a DC voltage.

92. Apparatus according to one of the claims 87 to 91, characterized in that it includes means of reception of the input reference signal that comes from an electronic module remote from the sensor.

93. Apparatus according to one of the claims 87 to 92, characterized in that the pixel array is exposed to visible radiation coming from the conversion of x-rays that have passed through a tooth.

94. Apparatus according to one of the claims 87 to 93, characterized in that the produced output signal is an analog output signal.

95. Apparatus according to claim 94, characterized in that the sensor is capable of delivering the analog output signal.

96. Apparatus according to claim 94 or 95, characterized in that it includes means of analog-digital conversion of the analog output signal into a digital output signal.

97. Apparatus according to one of the claims 87 to 96, characterized in that it comprises an electronic module remote from the sensor and a link between the module and the sensor for transmitting the sensor's output signal to the module.

98. Apparatus according to claims 96 and 97, characterized in that the electronic module comprises the means of analog-digital conversion.

99. Apparatus according to one of the claims 87 to 98, characterized in that the sensor has an x-ray converter that is capable of converting the x-rays that have passed through a tooth into visible radiation.

100. Apparatus according to claim 99, characterized in that the biCMOS detector including the active pixel array is capable of converting at least one part of the visible radiation coming from the conversion of the x-rays into at least one analog electrical signal.

101. Method of signal processing in a dental radiology apparatus comprising an intraoral sensor that includes an active pixel array produced using biCMOS technology, the pixels being arranged in rows and columns, the sensor delivering an analog output signal produced from the data values held by the array's pixels exposed to radiation, characterized in that, the pixels of at least one array column being optically inactive, the method includes the following steps:

- conversion of the analog output signal into a digital output signal,
- reading in the digital output signal of one or more data values coming from each optically inactive pixel of an array row,
- reading in the digital output signal of one or more data values coming from each optically inactive pixel of at least one adjacent row, the relevant pixel(s) of each of the two rows being equal in number and arranged in the same column(s),
- comparison of the data value(s) read respectively for the inactive pixel(s) of a row with the data value(s) read respectively for the inactive pixel(s) of said at least one adjacent row,
- according to the result of the comparison, decision-making as to any modification in the output signal of the data values of all the pixels of one of the rows used for the comparison.

102. Method according to claim 101, characterized in that, when the data values compared with one another are different from one row to another, the method includes a modification step, in the output signal, of the data value of each pixel of the adjacent row of the array.

103. Method according to claim 101, characterized in that the array's rows are compared two by two.

104. Method according to claims 101 to 103, characterized in that, when two consecutive array rows are compared, the modification is applied to the data values of the pixels of the second row.

105. Method according to one of the claims 101 to 104, characterized in that it comprises the following steps:

- reading of the data values $S_i(n)$, i=1 to m, coming respectively from a number m of optically inactive pixels of a first array row,

- reading of the data values $S_i(n+1)$ coming respectively from m optically inactive pixels of a second row which is the next row of the array,

- determining for each of the first and second rows an average data value $\overline{S}(n)$, $\overline{S}(n+1)$ obtained from the respective data values $S_i(n)$, $S_i(n+1)$ of each row,

- comparing the average data values $\overline{S}(n)$, and $\overline{S}(n+1)$ with one another,

- according to the result of the comparison, decision-making as to any modification, in the output signal, of the data values of all the pixels of the second row.

106. Method according to claim 105, characterized in that, when the compared average data values differ one from another, the method includes a modification step of the data value of each pixel of the second row by assigning to each of these data values the difference between the average data values $\overline{S}(n)$, and $\overline{S}(n+1)$ to adjust the average data value $\overline{S}(n+1)$ of the second row to the average data value $\overline{S}(n)$ of the first row.

107. Method according to one of the claims 101 to 106, characterized in that it includes a step of transmitting the analog output signal to an electronic module remote from the sensor, prior to the steps of reading the data values.

108. Method according to claim 107, characterized in that the step of converting the analog output signal is performed in the electronic module.

109. Method according to one of the claims 101 to 108, characterized in that it includes a prior step of reception by the sensor of an x-ray having passed through at least one tooth.

110. Method according to claim 109, characterized in that it includes a later step of conversion into visible radiation of the received x-ray, the array's pixels being exposed to visible radiation.

111. Dental radiology apparatus comprising an intraoral sensor that includes an active pixel array produced using biCMOS technology, the pixels being arranged in rows and columns, the sensor delivering an analog output signal produced from the data values held by the array's pixels exposed to radiation, characterized in that, the pixels of at least one array column being optically inactive, the apparatus includes:

- means for converting the analog output signal into a digital output signal,
- means for reading, in the digital output signal, one or more data values coming from each optically inactive pixel of an array row,
- means for reading, in the digital output signal, one or more data values coming from each optically inactive pixel of at least one adjacent row, the relevant pixel(s) of each of the two rows being equal in number and arranged in the same column(s),
- a comparator supplying a comparison of the data value(s) read respectively for the inactive pixel(s) of a row with the data value(s) read respectively for the inactive pixel(s) of said at least one adjacent row,
- decision-making means capable of providing a decision as to any modification in the output signal of the data values of all the pixels of one of the rows used for the comparison.

112. Apparatus according to claim 111, characterized in that it comprises means of modification, in the output signal, of the data value of each pixel of the array's adjacent row, when the compared values are different from one row to another.

113. Apparatus according to claim 111 or 112, characterized in that the pixels of the first three array columns are optically inactive.

114. Apparatus according to one of the claims 111 to 113, characterized in that it comprises an electronic module remote from the sensor and including the reading means, the comparator and the decision engine.

115. Apparatus according to claim 114, characterized in that it comprises means of transmission of the analog output signal to the electronic module.

116. Apparatus according to claim 114 or 115, characterized in that the electronic module comprises the means of analog-digital conversion.

117. Apparatus according to one of the claims 111 to 116, characterized in that the sensor has an x-ray converter that is capable of converting an x-ray having passed through a tooth into visible radiation.

118. Apparatus according to claim 17, characterized in that the sensor includes a biCMOS detector including the active pixel array and which is capable of converting at least one part of the visible radiation coming from the conversion of the x-ray into an analog electrical signal.